

# COMPUTER SCIENCE AND ECONOMICS

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Computer Science and Economics (CSEC) is an interdepartmental major for students interested in the theoretical and practical connections between computer science and economics. The B.S. degree in CSEC provides students with foundational knowledge of economics, computation, and data analysis, as well as hands-on experience with empirical analysis of economic data. It prepares students for professional careers that incorporate aspects of both economics and computer science and for academic careers conducting research in the overlap of the two fields. Topics in the overlap include market design, computational finance, economics of online platforms, machine learning, and social media. The CSEC major requires some classes in the intersection between Computer Science and Economics which are not mandatory for either major.

## PREREQUISITES

Prerequisite to this major is basic understanding of computer programming, discrete math, calculus, microeconomics and macroeconomics. Grades of 4 or 5 on high-school AP computer science, statistics, calculus, microeconomics, and macroeconomics signal adequate preparation for required courses in the CSEC major. For students who have not taken these or equivalent courses in high school, the programming prerequisite may be satisfied with CPSC 100 or CPSC 112; the discrete mathematics prerequisite may be satisfied with CPSC 202 or MATH 244; the calculus prerequisite may be satisfied with MATH 112; the microeconomics prerequisite may be satisfied with ECON 110 or ECON 115; and the macroeconomics prerequisite may be satisfied with ECON 111 or ECON 116. Other courses may suffice, and students should consult the director of undergraduate studies (DUS) and their academic advisers if they are unsure whether they have the prerequisite knowledge for a particular required course.

## REQUIREMENTS OF THE MAJOR

The B.S. degree program requires successful completion of fourteen term courses (not including courses taken to satisfy prerequisites) and the senior project. Nine of the fourteen courses are listed below; the remaining five courses are electives. With permission of the DUS and the academic adviser, a student may substitute a more advanced course in the same area as a required course. When a substitution is made, the advanced course counts toward the nine required courses and *not* toward the five electives.

The required courses include CPSC 201; CPSC 223; CPSC 323; CPSC 365 or 366; ECON 121 or 125; two courses in econometrics (ECON 117 and 123 or ECON 135 and 136); ECON 351; one course in the intersection of computer science and economics (e.g., CPSC 455, ECON 417, ECON 433 or CPSC 474) which may not also count as one of the five remaining electives. With permission of the DUS, S&DS 241 and S&DS 242 may be taken instead of ECON 135.

Elective courses are essentially those courses that count as electives in the Computer Science major, the Economics major, or both. ECON 122 and S&DS 365 can count as

an elective, ECON 159 can count as an elective. At least two electives must be taken in the Computer Science department, and at least one must be taken in the Economics department. With the permission of the academic adviser, a student may use as the fourth and/or fifth elective (one or two courses) in related departments that do not usually serve as electives in Computer Science or Economics.

**Credit/D/Fail** Courses taken Credit/D/Fail may not be counted toward the major.

#### SENIOR REQUIREMENT

In the senior year, each student must complete CSEC 491, a one-term independent-project course that explicitly combines both techniques and subject matter from computer science and economics. A project proposal must be approved by the student's academic adviser and project adviser, and it must be signed by the DUS by the end of the third week of the term.

**Distinction in the Major** Computer Science and Economics majors may earn Distinction in the Major if they receive grades of A or A- in at least three quarters of their courses in the major (not including courses taken to satisfy prerequisites), and their senior-project advisers determine that their senior projects are worthy of distinction.

#### ADVISING

**Approval of course schedules** Students considering the major but not yet declared should arrange to meet with the DUS during the registration period to ensure that their proposed course schedules are appropriate. Similarly, declared majors should meet with their academic advisers to ensure that they are on track to satisfy all of the requirements of the major. Course schedules must be signed by the DUS each term, and they must be approved by an academic adviser before the DUS signs them.

**Transfer credit** Students who take a term abroad or take summer courses outside of Yale may petition the DUS to count at most two courses from outside Yale toward the requirements of the major. Students who take a year abroad may petition to count at most three courses. Many courses taken outside Yale do not meet the standards of the CSEC major; therefore, students should consult with their academic advisers and the DUS *before* taking such courses. Courses taken outside Yale may not be counted toward the major requirements in intermediate microeconomics, econometrics, or the intersection of computer science and economics.

#### REQUIREMENTS OF THE MAJOR

**Prerequisites** Basic knowledge of programming, discrete math, calculus, microeconomics, and macroeconomics as determined by DUS and academic advisers, as indicated

**Number of courses** 14 term courses (not incl prereqs or senior req)

**Specific courses required** CPSC 201, 223, and 323; CPSC 365 or 366; ECON 121 or 125; ECON 117 and 123 or ECON 135 and 136; ECON 351

**Distribution of courses** 1 course in intersection of CPSC and ECON, as specified; 5 electives as specified

**Substitution permitted** S&DS 241 and 242 may substitute for ECON 135 with DUS permission; a more advanced course in the same area may substitute for a required course with DUS and academic adviser permission

**Senior requirement** CSEC 491

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The B.S. degree program requires successful completion of fourteen term courses and a senior project that explicitly combines both techniques and subject matter from computer science and economics. Nine specific courses must be taken by all CSEC majors, and the remaining five courses are electives.

Prerequisite knowledge for required courses in CSEC includes basic understanding of computer programming, discrete math, calculus, and economics. Prospective majors are strongly encouraged to meet with the director of undergraduates studies (DUS) as early as possible to determine which, if any, prerequisite courses they should take.

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